

*PSEUDOCRYPTOCHIRUS CRESCENTUS* (EDMONDSON),  
A SECOND CRAB OF THE CORALLICOLOUS FAMILY  
HAPALOCARCINIDAE (CRUSTACEA, DECAPODA)  
FROM THE EASTERN PACIFIC  
WITH REMARKS ON PHRAGMOSIS, HOST SPECIFICITY,  
AND DISTRIBUTION

JOHN S. GARTH †

ALLAN HANCOCK FOUNDATION  
UNIVERSITY OF SOUTHERN CALIFORNIA  
LOS ANGELES

AND

THOMAS S. HOPKINS\*  
SCRIPPS INSTITUTION OF OCEANOGRAPHY  
UNIVERSITY OF CALIFORNIA  
SAN DIEGO

INTRODUCTION

The coral-inhabiting family HAPALOCARCINIDAE is best known from the coral gall crab, *Hapalocarcinus marsupialis* Stimpson. Classical studies on its biology and morphology are those of Semper (1881) and of Potts (1915), whose work was done at Murray Island on the Great Barrier Reef of Australia. Knowledge of its occurrence in the eastern Pacific is comparatively recent, and is the result of the work of Hancock Expeditions off Central and northern South America. The first report was that of Schmitt (1936) from Port Utria, Colombia, the second that of Rathbun (1937) from Secas Islands, Panama, both collections from *Pocillopora* coral. The species was significantly absent from the Galápagos Islands, where numerous coral collections were made by *Velero III* scientists, but it has been reported more recently from Clipperton Island, also from *Pocillopora* coral (Garth, 1965).

The Clipperton Island collections, obtained by the late Conrad Limbaugh of the Scripps Institution of Oceanography on the I. G. Y. Expedition of 1958, also included a second and less conspicuous member of the family HAPALOCARCINIDAE which does not form galls in branching corals, but rather burrows into corals of a massive type. This was recognized as related to *Troglocarcinus* Verrill because of its resemblance to *T. corallicola* Verrill, an inhabitant of the western Atlantic better known to American workers as *Cryptochirus corallicola* (Ed-

†Contribution No. 312, Allan Hancock Foundation

\*Present address: University of West Florida, Pensacola, Florida

mondson, 1933). Since the genus was unknown from the eastern Pacific, the specimen was sent to Dr. Raoul Serène, joint author of a monograph on the Hapalocarcinidae of Viet Nam (Fize and Serène, 1957). Serène's identification, while allowing for minor discrepancies, left no doubt that the Clipperton Island specimen was conspecific with *Troglocarcinus crescentus* (Edmondson), more recently known as *Pseudocryptochirus crescentus* (Serène, 1966), originally described from Johnston Island, but subsequently reported from several other central and western Pacific localities.

This Clipperton Island occurrence, while establishing *Pseudocryptochirus crescentus* in the eastern Pacific at Lat. 10° 18' N. and Long. 109° 13' W. as reported by Garth (1965), left it still 600 nautical miles short of the American mainland. It remained for Mr. George F. Crozier of Scripps Institution of Oceanography, while diving in the Gulf of California off El Tule Ranch, 10 miles east of Cape San Lucas, Baja California, to recover the coral specimen that has yielded the first *Pseudocryptochirus* from the North American continent. The crabs were recognized (as *Cryptochirus*) by the junior author, who sent them to the senior author for study, together with the coral from which they were collected. The small series consists of one male and four female crabs, three of which are ovigerous. The male measures 3.6 X 2.65 mm, the non-ovigerous female 3.0 X 2.3 mm, and the only entire ovigerous female 4.6 X 3.7 mm in length and width of carapace. There is still another crab that can be seen at the bottom of its burrow that cannot be removed without damaging it extensively. Comparison of the five crabs with the specimen of *P. crescentus* from Clipperton Island leaves little doubt that they are the same species, again allowing for minor differences believed attributable to age and/or sex.

Strengthening the identity of both the Clipperton Island and the Gulf of California specimens of *Pseudocryptochirus crescentus* are the identities of their coral hosts. While the single specimen included among the decapod collections of Conrad Limbaugh bore no evidence of its coral host, two additional crabs were discovered by Dr. Edwin C. Allison clinging to Clipperton Island corals sent to him for study. These he identified as *Pavona clivosa* Verrill and *P. varians* Verrill. The coral host of *P. crescentus* on Johnston, Christmas, and Oahu islands is *Pavona duerdeni* Vaughan, according to Edmondson (1925, 1933). Indeed, all records given by Fize and Serène (1957) for this crab are from corals of the genus *Pavona*. The coral head from which the Gulf of California crabs were collected is a magnificent specimen of *Pavona gigantea* Verrill (Fig. 1), as identified by Dr. Allison, Department of Geology, California State College, San Diego, and Museum of Paleontology, Uni-



Figure 1 Entire specimen of the massive coral, *Pavona gigantea* Verrill, showing two of the crescent-shaped burrows from which *Pseudocryptochirus* crabs were extracted. The larger of these, presumably occupied by a female crab, is the one sketched in Figure 2 with crab *in situ*.

versity of California, Berkeley. Standing 15 cm high and measuring 14.5 cm in greatest diameter and 45.5 cm in circumference, it retains within its base a portion of the granite rock to which it was united before it was detached from the substrate. Widely spaced around its periphery, and in such a manner that only two, or at the most three, are visible in any one camera angle, are crescent-shaped burrows of the following dimensions in mm:

Height	Width	Depth	(Occupant)
4.5	7.9	30.1	(ov ♀)
3.3	7.0	16.8	(ov ♀)
3.1	7.0	---	( <i>in situ</i> )
3.0	6.8	12.5	(ov ♀)
1.9	7.1	8.5	(♂)
1.7	5.0	6.0	(non-ov ♀)

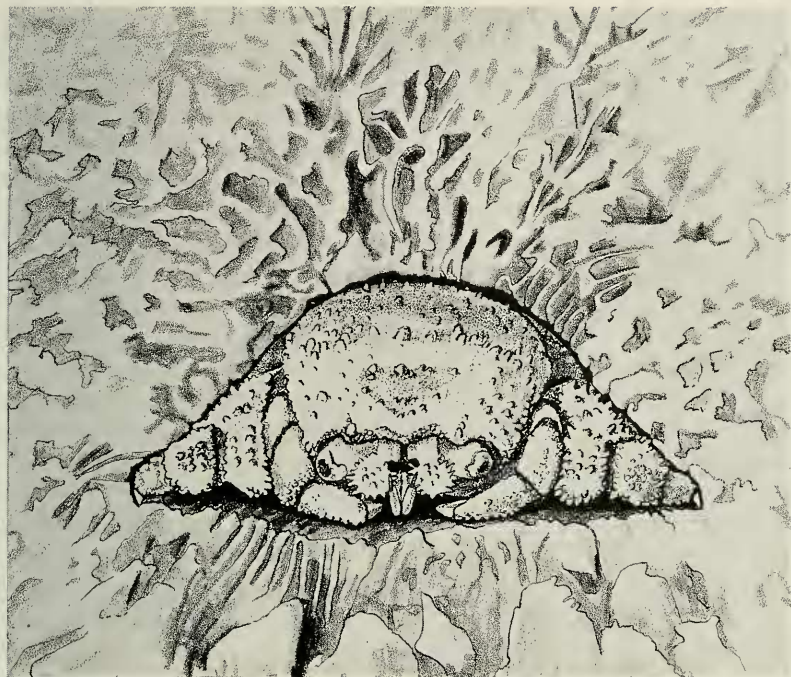


Figure 2 The burrowing coral crab, *Pseudocryptochirus crescentus* (Edmondson), in the characteristic position occupied at the entrance to its burrow, which it effectively closes. Jens W. Knudsen, del.

Since the crabs, with one exception, had been removed from their burrows before being seen by the senior author, it cannot be stated with certainty that a particular crab occupied a particular burrow. However, it will be noted that the number of burrows corresponds exactly with the number of crabs recovered or remaining *in situ*, that the number of large burrows (over 3.0 mm in height) corresponds to the number of ovigerous females, and that the number of small burrows (under 3.0 mm in height) corresponds to the single male and non-ovigerous female. It is also probable that the specimen remaining *in situ* is another ovigerous female, since the burrow that it occupies is of a height and width (its depth cannot be measured) comparable to the other large burrows. The greater proportional width of the burrow thought to have been occupied by the male would be an accommodation for the larger chelipeds in that sex.

A second point of confirmation of the identity of the Gulf of California crabs is found in the shape of the burrow. As the name would imply,



that of *Pseudocryptochirus crescentus* is crescentic, with the convexity of the burrow dorsal to the crab's position, the concavity ventral to it. But beyond the crescentic shape, which is shared to a degree by *P. viridis* (Hiro) of the western Pacific, there is a secondary excrescence above the carapace and the corners of the primary crescent turn downward to accommodate the crab's legs, giving a very characteristic shape to the opening. The anterior portion of the crab's carapace, including the greatly enlarged basal antennular segment, makes an abrupt angle with the carapace, and together with the similarly enlarged merus of the first walking leg, forms an effective operculum or closure (Fig. 2).

The process of modifying a part of the body to stop a hole for protection from predators, termed *phragmosis* by William Morton Wheeler, is found not only in insects, but among amphibians, reptiles, and in one genus of armadillo (Barbour, 1945). Phragmosis is common among anomurans, to which the hermit crabs belong, but is rare among brachyurans, or true crabs. Indeed, the formation of a *nidus* or nest of such a distinctive form or shape as to constitute a specific character, albeit an extra-corporeal one, while commonplace among birds, wasps, or trap-door spiders, is uncommon enough among brachyurans to merit special comment. According to Utinomi (1944:713), and with respect to *Pseudocryptochirus viridis*, which forms similar crescent-shaped holes on the coral *Turbinaria contorta*:

"It is clear that the crab settles down in the furrow between the calicles projected beyond the surface of the coral colony when it is immature, and then the hole it lives in becomes [*sic*] to form a crescent shape in accordance with its own characteristic shape. The pit is not deep, usually less than 5 mm . . . In the species *crescentus*, however, the dwelling is apt to grow deeper as the upward growth of the host coral *Pavona duerdeni* proceeds, although it lies obliquely to the surface of the coral."

Specimens of *Pseudocryptochirus viridis* from Eniwetok in the Marshall Islands and of the *Turbinaria* coral from which they were collected were available for comparison during this study.

Host specificity as between corals and their decapod commensals is a matter requiring further investigation. Among the Hapalocarcinidae, where coral and commensal have a demonstrable physical relationship, the crab existing either as a lifelong prisoner within the gall that the coral forms around it, or as the occupant of a burrow that the coral shapes to its body, while allowing the crab full ingress and egress, the problem is relatively simple, as crab and coral are usually collected and preserved together. Among the facultative symbionts of corals, such as the subfamily Trapeziinae of the family XANTHIDAE and the subfamily Pontiinae of the family PALAEMONIDAE, where the crab

or shrimp leaves no visible mark on the coral, evaluation of the situation is more difficult. The decapod crustaceans are most frequently separated from their coral hosts before the carcinologist receives them, or, equally deplorable from the ecologist's standpoint, are mingled with decapods from other corals. By employing methods especially developed to eliminate such cross-contamination, both Garth (1964) and Patton (1966) have been able to demonstrate selection preference on the part of both crabs and shrimps for host corals of a particular family. This is borne out in the relationship of *Hapalocarcinus marsupialis* with the family Seriatoporidae, including both *Seriatopora* and *Pocillopora*, on which the coral gall crab is found. While the relationship of *Pseudocryptochirus viridis*, found only on *Turbinaria*, and of *P. crescentus*, found only on *Pavona* to date, would appear to be a generic one, yet because each coral genus belongs to a different family, *Turbinaria* to the Dendrophyllidae, *Pavona* to the Agariciidae, it is perhaps too early so to state. However, it is already apparent that the *Pseudocryptochirus* species are not restricted to a single species of coral.

Finally, one comes to the significance of the transgression of the Pacific Oceanic Barrier by decapod crustaceans in general and by coral-inhabiting species in particular. This barrier, which consists of over 2,000 miles of open ocean between Hawaii and the Line Islands and the American west coast, is perhaps the most formidable known, exceeding for shore-bound marine animals even the Isthmus of Panama, a barrier of comparatively recent origin, geologically speaking (Ekman, 1953; Briggs, 1961). Such free-living decapod species as are known to occur on both sides of it are either those which make their way across the Aleutian arc, which rules out tropical species, or those known to be logriders, pelagic as adults as well as larvae, or susceptible to waif transportation in some form. On the other hand, many of the coral commensals are well established on both sides: of the family Alpheidae, the common *Alpheus ventrosus* and *Synalpheus charon*; of the family Palaemonidae, subfamily Pontoniinae, *Harpiliopsis depressus* and *Fennera chacei* (Bruce, 1965); among the family Xanthidae, subfamily Trapeziinae, *Trapezia ferruginea*, *T. digitalis*, and *Domecia hispida*, all members of the *Pocillopora* colony, family Seriatoporidae. (A similar suite of species inhabits corals of the genus *Acropora* in the western Pacific but is absent from American waters as is the host family, Acroporidae). The reasons for this selectivity are perhaps best summarized by Patton (1966: 293):

"It is indeed interesting that in the families Xanthidae and Alpheidae and in the subfamily Pontoniinae, all of which are abundantly represented on both sides of the East Pacific Barrier, the only species which extend across this barrier are

those which are obligate commensals on madrepora corals. It is possible that the commensals listed above have longer larval lives than their free-living relatives, although there is as yet no evidence for this. I agree with Garth (1946) that the specialized habitat of these animals provides a more likely answer. If a given locality in Pacific America contained the host coral, only a relatively few individuals would have to arrive for a commensal species to become established. Due to the special conditions of the coral habitat, it is unlikely that any local forms would be very well adapted to it, and the highly adapted commensals which arrived would therefore face little competition. This would be in marked contrast to the free living species, which would have to face strong competition from well established American forms and thus would have less chance of becoming established themselves."

The above remarks, while not intended to apply to members of the genus *Pseudocryptochirus* of the family Hapalocarcinidae, whose presence in the eastern Pacific was not then suspected, apply equally well to *P. crescentus*, now that its presence in the Gulf of California is known. To what other genera and species of corallicolous crabs they may be applied in the future depends on the energy and enterprise of a new generation of diver-collectors who may take inspiration from this brief account.

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